Integrating land use, land use change, and forestry into a mandatory national greenhouse gas reduction program[1]

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Introduction

The background paper for the Aspen Dialogue[3] examines three approaches to a mandatory national greenhouse gas reduction program, concluding that two options may be most feasible: a comprehensive cap-and-trade program and a sectoral hybrid program that combines a large-source downstream cap-and-trade program with product efficiency standards. This discussion paper examines policy issues that might arise if land use, land use change, and forestry (LULUCF) practices and projects were incorporated into those options.

LULUCF incorporation into a mandatory national program might take three basically different approaches:

- An *opt-in market approach*, where emitters can purchase carbon sequestration credits created in LULUCF projects that can help achieve compliance with an emissions cap.
- A *combination* approach where opt-in market credits and federal incentives (i.e. subsidies, technical assistance, etc.) are both featured. The market credits can help emitters reach individual caps while federal incentives produce sequestration that helps meet national targets, thereby mitigating the reductions needed under the cap program.
- A *regulatory approach*, where agricultural and forestry producers are brought into the framework of a mandatory economy-wide cap-and-trade program.

The paper focuses on the market and combination approaches, because the regulatory approach would raise exceedingly difficult political and administrative issues. Federal regulation of land use, particularly on private lands, is a politically explosive issue that could reduce the political viability of such a program.

Both the market and combination approaches offer opportunities to expand the political constituency for a national program, take advantage of existing federal and state programs and institutional capacity, achieve targeted GHG reductions, realize many ancillary environmental benefits, and broaden the reach of the national program.

Brief background on LULUCF

With carbon dioxide emissions dominating GHG emissions in the United States, there has been continuing interest in the processes and practices that remove carbon

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dioxide from the atmosphere and sequester it in stable forms on earth. The most basic process is that of photosynthesis and plant growth, which extracts gaseous carbon dioxide from the air and transforms it into the sugars, cellulose, and other organic compounds that make up plant material and soil organic matter. While much annual plant production is rapidly recycled back to the atmosphere by being eaten, decomposed, or burned within a matter of days or months, some of the carbon compounds are converted into long-lived products such as wood (lasting from decades to centuries in living trees and longer in stable wood products) and soil organic matter (which lasts from a few years to millennia).

Widespread opportunities for increasing carbon sequestration exist in agriculture, where changes in management practices such as reduced tillage or improved crop rotations and nutrient management can build and maintain new carbon stocks in agricultural soils. In forestry, management changes can increase forest growth rates and extend forest management cycles to produce larger timbers that remain in use longer than the smaller products of young trees. Changes in land use, primarily the conversion of marginal croplands to grass or trees, can provide lasting soil and water conservation benefits as well as carbon sequestration. Growing energy crops such as switchgrass or short-rotation woody crops results, in addition, in both industrial feedstocks that can replace fossil fuels.

In addition to carbon sequestration or emission reduction, some LULUCF activities affect other greenhouse gases. Methane is produced by ruminant livestock and manure decomposition, and its emission can be reduced by herd and grazing management, livestock feeding practices, and manure digestors that produce and capture methane for energy production. Nitrous oxide, while a potent GHG emitted from agricultural soil management activities, is difficult to measure or monitor under field conditions, and the scientific uncertainty around the effectiveness of various activities in reducing N_2O emissions may prevent it from being a candidate for inclusion in a national program, at least until more is known about its management.

National policies have recently added carbon sequestration as a purpose in federal conservation and forestry programs like EQIP (Environmental Quality Incentives Program) and FLEP (Forest Land Enhancement Program), administered by the Department of Agriculture. The new program enhancements contained in the Farm Security Act of 2002 (PL 107-171)) are now being implemented in the field by USDA agencies. While it is too early to judge results, these efforts build experience in carbon sequestration and add administrative capacity for future national efforts.

In February 2002, President Bush challenged the Department of Energy to develop improvements in the voluntary greenhouse gas reporting system under Section 1605(b) of the Energy Policy Act of 1992. At the same time, the President directed the Secretary of Agriculture, in consultation with DOE and EPA, to develop rules and guidelines for carbon sequestration projects. Drafting is under way, with the target of a new and expanded 1605(b) registry in early 2004. That registry can become a critical component of incorporating LULUCF in a national GHG reduction program.

The prospect of including LULUCF activities as an option in mandatory national or international emissions reduction programs has raised issues that need to be addressed. With the exception of saturation and permanence, these issues are not unique to LULUCF. They include:

- ***Additionality***. To reduce atmospheric CO_2 levels, the carbon sequestered must be additional to what exists or, under some interpretations, to what would have occurred without the practice or project. Different ways of approaching this issue have been proposed, based on the requirements of the program. They include:
    - If the national program requires LULUCF practices to reflect the gains as additional to what would have happened under a "business-as-usual" scenario, it will be necessary to predict future conditions without the project activity. This requires modeling or other methods to construct a logical and scientifically-based scenario. This is often called an "absolute quantity" requirement.
    - If the national program requires LULUCF practices to demonstrate increased carbon compared to the existing soil or forest system (a "rate-based" system), an initial measurement (or "baseline") can be established, and future measurements will reflect the additional carbon in the system.

- ***Leakage.*** The sequestration activity should not result in the shifting of carbon-emitting activities to other lands. Where this occurs, the credit given to the activity should be reduced to reflect a more accurate net impact on the global environment.

- ***Saturation***. There are limits to the amount of carbon that can be stored sustainably in soil or forest systems. Thus, carbon can be sequestered only until the system "saturates," at which point carbon stocks can be sustained, but additional sequestration will be limited. Depending on the initial carbon condition of the system, the climate, and the practices involved, these time periods range from a few to over 100 years (See Table 1).

- ***Permanence***. Because the carbon stored in woody vegetation and soils can be re-emitted through changes in management or natural disasters such as wildfires, the accounting system needs to calculate the value of carbon sequestered over different time periods, and/or provide for appropriate debiting of premature losses or emissions.

- ***Monitoring and Verification***. *C*redible monitoring and third-party verification can assure both buyers and regulators that claimed amounts of sequestered carbon are, in fact, legitimate. Available scientific methods produce credible monitoring and verification results for modest costs.

- ***Measurement and Transparency***. Because the amount of carbon credits claimed as emission mitigation represents the difference between what is produced and a baseline scenario, prevention of abuse requires that assumptions and calculations be transparent and available for review by observers, buyers, regulators, and independent auditors.

These issues have been widely researched, debated, and analyzed in the literature. The extent to which they will need attention in any future mandatory national program

depends largely on how comprehensively they are addressed in the forthcoming 1605(b) enhancements and the associated USDA and DOE policies. That will not be known for a few months, until the enhancements have been finalized and tested. In any case, it seems reasonable to allow time to demonstrate the capacity of the new 1605(b) rules before moving to new approaches.

Incorporating Market-Based LULUCF Projects into a Cap-and-Trade System

Policies seeking to incorporate LULUCF into a cap-and-trade system will need to provide for flexible means of meeting the cap, as discussed in the background paper. If regulated firms can choose least-cost options for meeting their target, and purchasing allowances from LULUCF projects is an option, the stage will be set. Such inclusion may raise some policy issues for consideration, such as:

Will allowing regulated firms to purchase carbon credits from LULUCF projects reduce the environmental effect of the national program?

This does not appear to be a problem if the construction of national targets and the rules on additionality (see above) are consistent. This can be achieved by taking the on-going and natural changes in agricultural soils and forest growth into account as part of the national target-setting exercise. If that is done, any project changes will reflect real environmental gains against the target.

Will additional administrative or institutional capacity be required if LULUCF credits are incorporated into a national cap-and-trade program?

Some additional capacity may be required, but it appears that today's agencies and programs can do most, if not all, that is needed. The capacity includes:

- The enhanced 1605(b) program and agency guidelines. It is too early to tell if these will provide the necessary capacity, but that is clearly the policy intent.

- USDA, state, and local agencies can provide technical assistance to landowners so that project plans and practices meet national criteria. However, budgets have always been a constraint.

- Emerging private organizations can create market opportunities (such as trading exchanges) and accumulator services (to assemble projects into "portfolios" that provide sufficient quantities to appeal to regulated firms and increase stability due to the diversity of projects and risks within each portfolio). Organizations such as the Chicago Climate Exchange, CO2e, the National Carbon Offset Coalition, and others are working in these areas. Many credible consulting firms are capable of doing monitoring and verification.

Thus most, if not all, of the needed pieces for a national program to supply carbon credits on a market exchange are now in operation, at least in fledgling stage. What are not available are potential buyers. A mandatory cap-and-trade program could create such

buyers, and the emerging market would then establish real experience in supply, demand, and price. Until that market is established, estimates as to how effectively market-based LULUCF projects could contribute to national goals, or where they would fit in the emerging spectrum of approaches to reducing GHG emissions, are largely speculative.

Incorporating LULUCF into a Hybrid Program

While the role of LULUCF projects in the cap-and-trade portion of a hybrid program could be the same as described above, it is possible to supplement projects with non-regulatory programs such as those contained in the 2002 Farm Bill.

Under this scenario, the national reduction goal could be addressed by three related efforts: 1) a downstream cap-and-trade program for large sources in the electricity and industrial sectors; 2) enhanced product efficiency standards for small GHG sources; and 3) expanded national efforts to increase carbon sequestration and renewable energy production on agricultural and forest lands.

Increasing USDA focus on expanding carbon sequestration and renewable energy production would have several effects, including:

- It would offer landowners a wider range of choice. They could establish and maintain practices such as reduced cultivation and accept a modest per-acre cost-share payment that would be based on a conservative estimate of carbon impact.

- If they desired, landowners could go beyond the federal program and install more intensive practices under a project plan, undertake the necessary measurements, monitoring, and legal transfers, and sell credits into a trading system. This has raised the issue of "double-payment" where a landowner might receive cost-sharing for a water quality or erosion control practice, then sells the associated carbon credits on the market. Current USDA policy, however, maintains that the amount of cost-share reflects only the public conservation benefits and is not intended to cover carbon values. Current payment rates are clearly inadequate to cover the costs of installing the monitoring, verification, and legal transfers involved in qualifying a project-based carbon credit.

- It could bring a broader political constituency into the development of the national program. If a national GHG reduction program threatens higher energy costs for agriculture and forest producers but also offers new income opportunities for them, they might support the tradeoff.

- It would strengthen sustainability and environmental performance in the rural sector.

Table 1. Potential effect of selected conservation practices on carbon sequestration or emissions reductions.

Conservation Practice	Potential GHG Effect (tC/ac/yr)*	Duration of carbon sequestration before saturation (assumes continuity)
Improved Cropping Systems	0.04 to 0.12	15-50 years (depends on initial condition as well as crops, inputs & climate)
Cropland to Grassland	0.03 to 0.45	10-25 years (same as above)
Intercropping	0.1 to 0.4 (?)	Not estimated
Conservation Tillage	0.15 to 0.25	5-15 years (same as above)
Windbreaks & Shelterbelts	0.25 to 0.7	30-70 years
Improved Forest Management	0.1 to 1.4	If wood products are included, saturation may not occur; otherwise 20-100 years.
Energy Crops	1.3 to 1.5	If grown sustainably and used to offset fossil energy, saturation should not occur.
Riparian Forest Buffers	1 to 3 (?)	50-100 years
Cropland to Forest	0.5 to 2.6	50-100 years
Drainage, Wetland Restoration	????	Not estimated
Improved Fire Management (emissions reduction)	????	Not estimated

Sources: Lal et al. 1998; Kimble et al. 2002; Sampson et al. 2000

* Any associated changes in inorganic carbon compounds or emissions of methane or nitrous oxide are not included.

(?) – Indicates that these practices have little research in the U.S. upon which to make estimates.

???? – Indicates that these practices may have both positive and negative effects on GHG balances.

Potential impact of including LULUCF in a mandatory national GHG reduction program.

As noted above, until there are serious buyers in a GHG trading market, it is difficult to estimate the market share that could be filled by LULUCF practices and projects. At the same time, there is little doubt that the potential in improving land management practices in agriculture and forestry is significant. U.S cropland soils currently sequester about 20 million metric tons of carbon (MMTC) per year and have an estimated potential to sequester 60-150 MMTC more (Pew Center (undated)). Kimble et al. (2002) estimate that forest soils (both public and private) could, under a variety of management and land conversion practices, sequester from 49 to 186 million metric tons of carbon per year, while the amount of carbon sequestered in wood would be four to six times as much as that sequestered in the soil. From a national point of view, achieving any significant amount of this potential could make a major contribution to greenhouse gas mitigation. In terms of individual practices, Table 1 illustrates the potential of different agricultural and forestry activities to sequester carbon.

Some other potential impacts include:

- ***Enhanced environmental quality***. Improving agricultural and forest lands through well-designed carbon sequestration activities has the effect of improving soil quality, increasing vegetative cover, reducing soil erosion and downstream water pollution as well as air pollution, and improving wildlife habitat. Those benefits accrue largely to the public rather than to the landowner.

- ***Contributing to rural sustainability***. Private landowners need revenue to support agricultural or forestry businesses. Where markets are lacking, or prices too low, those businesses fail and the land, in many cases, is converted to development. As rural businesses fail, supporting infrastructure shrinks, putting added pressure on remaining farms and forests. If carbon sequestration or renewable energy can provide new revenue streams, they may help retain rural landscapes and economies.

- ***Buffering cost inflation in the national program.*** While there is not enough experience in marketing LULUCF carbon credits to provide solid evidence, experience to date suggests that the combination of establishment and maintenance costs to the landowner, the transaction costs needed to measure, monitor, verify, and register project credits for the market, and the trading costs incurred will produce an entry level price of something in the range of $2.50 to $5.00 per tonne of CO_2 sequestered. If that is true, regulated firms should adopt technological and efficiency improvements until the entry costs are reached. Once prices draw LULUCF credits into the market, however, there appears to be a large potential supply. If that is the case, prices could stabilize somewhere around the market entry price ($2.50-$5.00 per tonne) for those credits.

- ***Increasing political complexity***. Incorporating LULUCF as an option in a national mandatory program involves different Congressional committees, different federal Departments, and different political constituencies. While it could broaden support for a comprehensive program, it could also make it more difficult to achieve policy consensus.

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